In 1904, when the author took comparison photographs from nearly the same spot, this large crater was almost entirely filled up, and the slope of the Sciara was continued upwards, so that the cone of ejecta overtopped and was visible behind the eastern Torrella. The activity in this eastern part of the crater still maintained the same quiet character as in 1888. The whole area constantly emitted vapour; there was more than one bocca visible, but they were quite small and only gave very feeble explosions, and these with a rhythm quite independent of those at the western part of the crater.

Fig. 2, taken by the author on April 20, 1904, from a point to the west of the crater, and consequently in almost exactly an opposite direction to Fig. 1, shows the condition of the western part of the crater sixteen years later. The conspicuous rock to the right of the plate is the western Torrella, behind which, in 1888, was the great crater above referred to. The bocca to the left, from which the explosion is taking place, is shown in some of the earlier photographs as situated on the edge of the large crater at its junction with the Sciara. The great crater is now seen to be filled up by ejecta which prolong the slope of the Sciara upwards over what was previously its site, while the bocca itself remains in all probability really in its former position, though apparently on the slope of the Sciara instead of on its edge.

It will be interesting to future visitors to see whether the volcano will continue to prolong the slope of the Sciara much further upwards, or whether a paroxysmal explosion will occur which will clear the great crater again.

The paper in the *Geographical Journal* is illustrated with twelve photographs and a map showing these and other points more in detail.

THE INSTITUTION OF NAVAL ARCHITECTS.

THE annual spring meeting of the Institution of Naval Architects was held last week, commencing on Wednesday, April 12, and being continued over the two following days. The president of the institution, the Right Hon. the Earl of Glasgow, occupied the chair. A very full programme had been arranged, there being no less than fifteen papers set down for reading and discussion, and there was also the presidential address.

The first business after the usual formal proceedings was the reading by the secretary, Mr. R. W. Dana, of the report of the council. By this it appeared that the institution is in a prosperous condition, both in regard to finance and membership. Reference was made to the proposed foundation of an experimental tank for the purpose of scientific investigation of problems connected with ship design. It will be remembered that it was proposed, at the initiative of Mr. A. F. Yarrow, Dr. Elgar, Sir William White, and other prominent members of the institution, that an institution tank should be founded in connection with the National Physical Laboratory. Such a tank, devoted to research of a scientific nature, would be of great benefit to the ship-building industry, and would do much to raise naval architecture to a higher plane by the substitution of scientific principles for those empirical methods upon which ship designers too largely have to rely. It is much to be regretted, therefore, and not very creditable to an important and wealthy industry, that the appeal made by the council of the institution has met with so poor a response. Only six thousand pounds out of the fifteen thousand pounds needed has been underwritten, so that the project is shelved for the present. In spite of the enormous preponderance of the ship-building interests of this country, there are but two experimental tanks in the kingdom. One is the property of the Government, and is devoted wholly to the Royal Navy, the other being the property of a private firm of ship-builders on the Clyde. Both these tanks are devoted entirely to what is known as "practical work," that is to say, they attack subjects piecemeal, and therefore in a more or less empirical fashion. They have no time for ordered investigation of fundamental principles, upon a knowledge of which, alone, can a useful superstructure of applied science be raised. The tanks are not to blame for this. They were established for a definite purpose, which they admirably fulfil.

In the presidential address Lord Glasgow, among other subjects, referred to the spread of the steam turbine for marine propulsion, alluding more particularly to the recent trials of H.M.S. *Amethyst*. Some interesting comparisons were made between the performances of this cruiser, which is fitted with steam turbines, and the *Topaze*, a similar ship in all respects, excepting that she has ordinary crank and cylinder engines. As is well known, the steam turbine is less "flexible," to use an expression that has come into use, than the reciprocating engine; that is to say, its efficiency falls off rapidly when it is run at lower powers than that for which it was designed to give maximum efficiency. This point was well illustrated during the trials of the *Amethyst* and the *Topaze* by the coal consumption, the figures being given in Lord Glasgow's address. The steam turbines of the *Amethyst* drove her at 23½ knots, 5·45 per cent. faster than her sister ships with reciprocating engines. At the higher speeds the turbine engines appeared decidedly more economical; at lower speeds the reciprocating engines had the advantage. At 10 knots a ton of coal would carry the *Amethyst* 7·42 miles, or the *Topaze* 9·75 miles. From this speed upwards the margin in favour of the reciprocating engines decreased, until the consumption curves would cross at a little above 14 knots, when approximately 6½ miles would be steamed on a ton of coal. At a speed of 20 knots the *Amethyst* ran 4·22 miles, and the *Topaze* 2·9 miles, per ton of coal burnt. At 23·6 knots, a speed the *Topaze* did not reach, the *Amethyst* would steam a little more than 2 miles per ton of coal. If it may be allowed that about 14 knots is the lowest speed at which these cruisers could be advantageously run in time of war, the steam turbine has a marked advantage for warlike purposes; but it might lead to higher coal consumption in time of peace.

The first paper taken was a contribution by Mr. W. E. Smith, of the Admiralty, upon the design of the Antarctic exploration vessel *Discovery*. This was a single screw wooden steamer 175 feet long, 34 feet wide, and about 1620 tons displacement. The propeller was so arranged as to be disconnected from the shaft and lifted into a well, after the manner adopted in the old steam frigates. The rudder was also arranged to be readily unshipped. The scantling of the hull was massive, but in general plan followed the designs adopted in the days of wooden construction. The vessel was fully rigged as a barque. The fitting of a magnetic observatory was one of the special features of the design. The work done here was of great magnitude, and the observations taken are now being analysed by Captain Chetwynd, the Admiralty superintendent of compasses. No magnetic metal was allowed within a radius of 30 feet of the observatory. Main shrouds were of hemp, the lanyards being rove through wooden dead eyes. Great care was taken to lag the living part of the ship so as to economise coal. Professional details of the design were dealt with at some length. In the discussion on this paper, Sir Clements Markham gave some historical details of former Polar expeditions, and dwelt upon the advantage of having a ship expressly built for the purpose. Captain Scott, who was in charge of the expedition, Sir William White, and Admiral Fitzgerald also spoke.

The next paper was by Colonel Soliani, of the Royal Italian Navy, and gave technical details of the Japanese war vessels *Kasuga* and *Nisshiu*, both built in Italy. A paper by Mr. H. Rowell giving an account of the Russian Volunteer Fleet followed.

The second day of the meeting opened with a paper by Prof. J. H. Biles, who gave details of trials made to test the strength of a torpedo-boat destroyer supplied for the purpose by the Admiralty. The vessel was placed in dry dock, being supported on cradles near the ends, so as to produce sagging stresses, and in the middle in order to induce hogging. The experiments were part of the investigation of the Admiralty Destroyer Committee. The results were set forth at considerable length in the paper and in the large number of diagrams which accompanied it. It will be sufficient to say here that the actual results observed on these practical trials established the usual methods of calculation as affording a good margin of safety, the stresses in the observed results being consistently below those calculated by the formulæ commonly used by naval architects.

A paper on a similar subject was read by Mr. F. H. Alexander.

A long and elaborate paper, illustrated by numerous diagrams, was next taken. The subject was the structural arrangements of ships, the author being Mr. J. Bruhn. Details of tests of frame girders, on the strength of flanged plates, on intercostal stringers, on the tripping of frames, and the strength of rivet attachments, were described. The paper was of considerable professional interest, and will form a valuable source of information to naval architects; but without the aid of the numerous illustrations and diagrams it would be impossible to make the descriptions clear.

At the evening meeting of the same day a paper by Mr. R. E. Froude on hollow *versus* straight lines opened the proceedings. The subject has attracted a good deal of interest of late, and has already led to some discussion. A number of naval officers, led by Admiral Fitzgerald, hold that a great mistake is made by building ships for the Royal Navy with hollow lines. Sir William White and the other naval constructors naturally defend their practice, supporting their arguments by the actual results obtained at the Haslar tank. The naval men reply that, even allowing the superiority of hollow lines in the smooth water, at which all tank experiments were made, the hollow lines gave a slower vessel amongst waves, and also a wetter ship. In order to bring the matter to a practical issue, a number of experiments were made by Mr. Froude at the Haslar tank, in which artificial waves were created by a mechanical device. The results were plotted on diagrams attached to the paper, the general conclusion arrived at by Mr. Froude being that though there was a distinct diminution in average effective horse-power due to straight lines, yet this was insufficient to annul the greater efficiency of the hollow lines in smooth water. In the discussion that followed, Admiral Fitzgerald joined issue on this point. He held that quite smooth water was comparatively rarely met with at sea, and he considered it was a question for naval officers, and not for naval architects, to decide under which condition they would prefer the higher efficiency. Moreover, the straight lines gave greater displacement forward without extra cost, and the additional buoyancy could be used for placing heavier guns forward, or in other useful ways. Prof. Biles also joined in the discussion. He gave the results of trials on this subject made at the Dumbarton tank. These results were in contradiction to those given in Mr. Froude's paper, and until this discrepancy is explained the subject must remain unsettled. The need for an independent tank devoted to experimental investigation is apparent. Mr. Froude's experiments are extremely interesting, as being the first tank trials made in other than smooth water. When it is remembered how little smooth water there is at sea, and how widely the conditions of resistance and other qualities are altered by waves, the advantage of the new departure will be apparent.

An interesting paper by Mr. A. W. Johns, of the Royal Corps of Naval Constructors, was also read at this sitting, the subject being the effect of motion ahead on the rolling of ships. The subject is one both of interest and importance, and was worked out by the author with considerable ingenuity, theoretical results being compared, with those obtained by experiment. It would appear that the effect of speed is to reduce rolling, but no doubt further tests will be made, the actual experimental data up to now being somewhat meagre.

Mr. Stromeyer also read a paper on the effect of acceleration on ship resistance.

Another paper was down for reading at this sitting, but unfortunately time did not permit of it being read. It was by Mr. S. Popper, of Pola, the subject being the results of model experiments in deep and in shallow water. The subject is one of considerable practical importance at the present time, when builders of destroyers in the south find it pays them to send their vessels to the measured mile on the Clyde, where there is deep water. They find the Clyde mile permits of a knot more being made than can be obtained on any of the comparatively shallow miles of the south.

On Friday, April 14, five papers were taken. Mr. A. E. Seaton contributed the first, the subject being margins and factors of safety and their influence on marine designs. Mr. J. H. Heck followed with some notes on the variation of angular velocity in the shafting of marine engines; and Mr. Mallock read a brief paper in which he described an ingenious device for keeping the two sets of engines of a twin screw vessel out of step, so as to prevent vibration. Mr. Attwood also read a paper on the Admiralty course of study for the training of naval architects.

Perhaps the most interesting paper of the meeting was that which came last. It was by Mr. J. B. Millet, of Boston, Massachusetts, and described a means of submarine signalling by sound, of which more will probably be heard in the future. Briefly it may be said that the sides of the ship itself are used as receivers. A tank filled with a dense liquid is attached to each side of the ship. In this a transmitter is placed, and the sound collected is taken by wires to an observer, who may be in any part of the vessel. If the source of sound is on the port side the sound will be apparent from the port transmitter; if on the starboard side the starboard transmitter will be affected; if it is directly ahead it will be heard equally through both transmitters. When the sound is astern a different effect is produced. As the result of practical trials, the positions of passing ships and of submarine bells were accurately defined. When it is remembered how untrustworthy sound signals are when passed through air, and how unchanging is the density of water, it will be seen that the new system promises to reduce the chief dangers of modern navigation, collisions, or strandings through fog. The idea of submarine sound signals, of course, is not new, but the hitherto insuperable difficulty in the way has been the confusion of sound through the overwhelming nature of the noises in the ship itself. Mr. Millet, however, appears to have overcome this difficulty, and the testimony as to the value of his invention is very strong.

The meeting was brought to a conclusion by the usual votes of thanks.

UNSOLVED PROBLEMS IN ELECTRICAL ENGINEERING.

ON April 10 Colonel R. E. Crompton delivered the annual "James Forrest" lecture of the Institution of Civil Engineers, an abstract of which is given below.

There are two groups of electrical problems, those which concern the scientific investigator and those presenting themselves to engineers. The lecturer dealt with the latter only. The phenomena of lightning discharges, especially where they affect the distribution systems of large electric power plants, require further study. Many failures are due to causes which the lecturer believes to be static discharges due to gigantic condenser effects set up in systems of well insulated overhead and underground conductors, each system acting as a plate of the condenser.

Interesting problems arise out of terrestrial magnetism; the present hypotheses are based on scant knowledge. It is known that the earth's magnetic field is not symmetrical, but the work of observing the variations of the earth's field at public observatories all over the world may eventually enable the earth's field gradually to be plotted out.

Another problem passing into the domain of engineering is the etheric transmission of power. What is now required is a better solution of the problem of producing continuous trains of Hertzian waves either by mechanical means or by electrochemical means.

The lecturer dealt rather fully with what he called the "core and coil" problem of electrical machinery, that is to say, the problems connected with the perfecting of the cores, hitherto of iron, but which in future may be made of some of the alloys invented by Dr. Huesler, which are now under test.

Dealing with the present means of using iron or steel castings of high permeability, the best methods were discussed of freeing them from blow-holes or porosity to ensure that the magnet cores should be of equal density of mass, and therefore of equal magnetic moment. In this connection the lecturer alluded to Prof. Barrett's discovery of